

**Original article****ROLE OF B-TYPE NATRIURETIC PEPTIDE IN DIFFERENTIATING CARDIAC DYSPNEA FROM THAT OF PULMONARY ORIGIN IN EMERGENCY CARE SETTING.**

Nazir Ahmad Lone , Darminder Kumar

**Abstract****Background:-**

Heart failure burden has rapidly increased and likely to worsen due to current demographic and disease patterns..Good number of heart failure patients are being missed in emergency setting. To avoid this miss diagnosis in emergency department we tried to find the role of BNP levels as they are envisioned to fill this void..

**Methods:-**

A total of seventy-two patients with acute dyspnea presenting in the emergency department of a tertiary care hospital of Kashmir were studied after fulfilling the required protocol.4cc blood sample was taken in EDTA tube for estimation of plasma BNP level .The plasma BNP levels were analyzed by chemiluminescent sandwich immune assay having dynamic range 0-5000 pg/ ml , and cut point for heart failure of 100 pg/ml.

**Results:-**

In our study patients with final diagnosis of heart failure 44 patients had significantly higher level of BNP than patients without heart failure (399.6+- 289.2 pg/ml versus 84.9+- 84.9+- pg/ml.).

**Conclusion:-**

BNP estimation is underutilized in emergency care setting while evaluating acute dyspnea in our hospitals. Plasma.BNP level estimation is a cost effective addition to diagnostic armamentarium of acute care physician.

**JK-Practitioner2021;26(1):10-14****Introduction**

Heart failure is a principal complication of virtually all forms of heart disease. Its burden has increased by many folds due to changing demographics, increasing burden of its risk factors like hypertension and diabetes and also better management of coronary artery disease leading to higher number of its survivors but with impaired heart function.The prevalence of heart failure increases dramatically with age, occurring in 1 to 2 % at 45 to 54 years of age and up to 10 % of individuals older than 75 years of age<sup>1,2</sup>. Heart failure is often difficult to diagnose in the emergency department or urgent care setting. The symptoms may be nonspecific and physical findings are not sensitive enough to use as basis for an accurate diagnosis<sup>3,4</sup>. Although echocardiography is considered the gold standard for the detection of left ventricular functions, it is expensive, is not always easily accessible and may not always reflect an acute condition<sup>5</sup>. Misdiagnosis of congestive heart failure can be life threatening because some of drugs used for congestive heart failure are hazardous to patients with other conditions such as chronic obstructive pulmonary disease that have same primary symptoms at presentation<sup>6</sup>. Natriuretic peptides have guided us as a diagnostic and prognostic tool for the management of heart failure and is established in various clinical trials.

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**Key word:**

Dyspnea, Natriuretic Peptide

B-type natriuretic peptide ( BNP ) and its aminoterminal cleavage equivalent N-terminal (NT) -proBNP are released into the circulation from myocardium as and when diastolic wall stress increases as a result of increase in volume or pressure. From a physiological stand point, BNP has an important role in congestive heart failure as a counter regulating hormone to angiotensin-11, norepinephrine and endothelin, because it decreases synthesis of some of these neurohormones and acts like a balanced vasodilator. Furthermore, as a result of its hemodynamic effects and direct tubular action BNP has natriuretic and diuretic effect and its plasma concentration correlates in a superior way with pulmonary capillary wedge pressure, left ventricular end-diastolic pressure and left ventricular ejection fraction in patients with systolic dysfunction<sup>7,8</sup>. This study sought to compare the utility of measurement of plasma brain natriuretic peptide ( BNP) in the diagnosis of heart failure ( HF ) in patients with acute dyspnea presenting in the emergency department of a tertiary care hospital of Kashmir valley.

#### METHODS

The protocol was approved by the Ethical Committee of the hospital, and participants gave informed consent. Seventy two patients with dyspnea presenting to the emergency department of the hospital were enrolled. All those patients whose dyspnea was not clearly secondary to CHF (Trauma or Pericardial effusion) were excluded. Patients with acute coronary syndrome and renal failure were also excluded from the study. In all selected patients about 4 ml of blood was taken in an EDTA tube for measurement of plasma BNP level, at the same time other data of the patient were recorded including past history, present history, physical examination, reports of blood tests, interpretation of ECG and X-ray chest. Echocardiography was strongly encouraged in the emergency department or in the cardiology ward. Emergency physician or first contact cardiologist were asked to make an assessment of the patient on the basis of history, physical examination and baseline investigations, and give probable diagnosis while blinded to the results of BNP level. On echocardiography we examined both systolic and diastolic functions. To determine the patient's actual diagnosis as a cause of dyspnea, two cardiologists or team of cardiology department were asked to give independent assessment as a cause for dyspnea after reviewing all

records including echocardiographic data, while they were also blinded to the result of BNP levels.

The blood sample was centrifuged and plasma was removed, aliquoted and frozen at -70 degree C before analysis. Subsequently analyzed by chemiluminescent sandwich immuno assay; which has imprecision total % CV of 2.3 to 4.7, dynamic range 0-5000 pg / ml and cut point for heart failure of 100 pg/ml.

#### Statistical analysis

Group comparison of clinical variable were made with their value expressed as mean  $\pm$  SD for parametric variable and in percentages for non-parametric variable. Group comparison of BNP values was made using t-test for independent samples. To evaluate the utility of BNP in the diagnosis of heart failure, we compared the sensitivity, specificity and accuracy of BNP measurement to individual findings, to a multivariate model of clinical findings and to clinical judgment.

#### RESULTS:-

The baseline characteristics of the included patients are summarized in Table 1. Their mean age was 58.6  $\pm$  10.2. 65.3% patients were males and 34.7 % were females. Their diagnosis as a cause of dyspnea by emergency physician was heart failure in 55 patients ( 76.4 % ) versus no heart failure in 17 patients ( 23.6 % ) Table 2. The final diagnosis as a cause of dyspnea; Heart failure – 44 patients ( 61.1 % ) versus no heart failure 28 patients ( 28.9 % ) Table 3. The diagnostic accuracy of emergency physician was 84.7 % and miss diagnosis rate was 15.3% Table 4. 44 patients with diagnosis of heart failure , 12 patients had only systolic heart failure (Left ventricular ejection fraction less than 50% ) with BNP levels 652  $\pm$  345 pg / ml which is significantly higher than other groups. In comparison patients with only diastolic heart failure 12 in number ( echo documented diastolic dysfunction but normal ejection fraction ) BNP levels were 250  $\pm$  154 pg / ml. While as patients with systolic as well as diastolic heart failure 18 in number with BNP levels 352  $\pm$  224 pg / ml and others 2 in number ( Patients with normal systolic and diastolic function but with flash pulmonary odema because of accelerated hypertension, atrial fibrillation with fast ventricular rate ), were having BNP levels 195  $\pm$  12.02 pg / ml. Overall patients with heart failure were having significantly higher levels of plasma BNP levels as compared to patients with no heart failure. (Table 5)

**Observations:****Table 1 Baseline Characteristics of 72 Studied Patients**

Characteristic		N	%
Age	Means $\pm$ S (Range)	58.6 $\pm$ 10.2(26,80)	
Gender	Male	47	65.3
	Female	25	34.7
Past History	Hypertension	54	75.0
	Diabetes Mellitus	20	27.8
	Myocardial Infarction	25	34.7
	COPD	44	61.1
	CCF	15	20.8

**Table 2: Diagnosis as a cause of Dyspnea in the studied patients as diagnosed by Emergency Physician or 1st contact Cardiologist**

Diagnosis	N	%
No Heart Failure( COPD with Acute Exacerbation)	17	23.6
Heart Failure	55	76.4

**Table- 3: Final Diagnosis confirmed by two cardiologists or team of cardiology for the diagnosis as a cause of Dyspnea in the studied patients.**

Diagnosis		N	%
Heart Failure (n=44)	Heart Failure (Flash Pulmonary Oedema)	2	2.8
	Heart Failure	42	58.3
No Heart Failure (n=28)	COPD with Acute Exacerbation	2	33.3
	COPD with Acute Exacerbation, Pneumonia with Underlying LV Dysfunction	2	2.8
	HRCT proved Interstitial Lung Disease	2	2.8

**Table- 4: Correlation of Emergency Physician or First Contact Cardiologists Diagnosis with Final Diagnosis.**

Heart Failure (Final Diagnosis)	Emergency Physician or First Contact Cardiologist						Conclusion
	Heart Failure		No Heart Failure		Total		
	n	%	N	%	n	%	
Yes	44	80.0	0	0.0	44	61.1	P=0.000(sig)
No	11	20.0	17	100.0	28	38.9	
Total	55	76.4	17	23.6	72	100.0	

**Table- 5: Plasma BNP level (pg/ml) in relation to final diagnosis**

Characteristic	Heart failure (n=44)	No heart Failure (n=28)	Result	conclusion
Plasma BNP Level (pg/ml)	399.6 $\pm$ 289.2	84.9 $\pm$ 42.4	0.000	sig

**Discussion:-**

Heart failure is often difficult to diagnose in the emergency department or in urgent care setting. The symptoms may be non-specific and physical

findings are not sensitive enough to use as basis for an accurate diagnosis<sup>3,4</sup>. A helpful history is not obtainable in an acutely ill patient, and dyspnea, a key symptom of CHF may be nonspecific finding in elderly or obese patient in whom comorbidity with respiratory disease and physical deconditioning are common<sup>7</sup>. B-type natriuretic peptide has gained lot of popularity as a potential marker for heart failure and many studies have shown a good correlation between the extent of elevation of BNP and presence of heart failure<sup>9-13</sup>. The European Society of cardiology guidelines<sup>14</sup> have incorporated BNP as a marker for diagnosis and prognosis, while the American College of Cardiology/ American Heart Association guidelines recommend that in patients presenting with dyspnea, measurement of natriuretic peptide biomarkers is useful to support a diagnosis or exclusion of Heart failure<sup>15</sup>. Present study was first of its kind that was conducted at our centre to check the utility of BNP levels in patients presenting with acute dyspnea in the emergency department of our institution. Diagnostic accuracy of emergency physician/ cardiologist was 84.7% and miss diagnosis rate was 15.3% in our enrolled patients. This finding is consistent with the findings of Damien Logeart et al<sup>16</sup> on comparative value of Doppler echocardiography and B-type natriuretic peptide assay in etiological diagnosis of acute dyspnea and also in studies conducted by Quyen Dao<sup>17</sup>, Krishnaswamy et al<sup>10</sup> in 250 patients presenting in to urgent care setting. In our study plasma BNP levels of heart failure patients (n= 44) was 399.6  $\pm$  289.2 pg/ml whereas in case of no heart failure group (n= 28) was 84.9  $\pm$  42.2 pg/ml a statistically significant difference. Our findings of high BNP levels in heart failure patients are consistent with earlier studies<sup>16-21</sup>. However in these studies the BNP levels were much higher as compared to BNP levels in our heart failure patients. This could be because of large sample size and different study population than those of our study. This variation of BNP levels could be because of inclusion of low risk heart failure patients also grade 11 to 111 diastolic dysfunction where as in these studies most of patients were having Grade 111 to 1V diastolic dysfunction. Univariate analysis of Plasma BNP level at different cut off level between 50 pg/ml to 175 pg/ml, showed that at cut off level of 175 pg/ml BNP is most accurate variable out of all with accuracy of 87.5%, sensitivity of 81.8%, specificity of 96.4%, positive predictive value of 77.1%. At cut off level 80 pg/ml, BNP was very sensitive with sensitivity of 97.7% and negative

predictive value of 92.3 %. Etiologic value of BNP was low in patients with levels between 80 pg/ml to 175 pg/ml. This range needs confirmation from clinical judgment and adjunctive testing. The results of our study are almost consistent with earlier studies<sup>11,17,22</sup>. Multiple variable logistic regression analysis of various factors used for differentiating between patients with and without heart failure with significant p value, we found that the addition of BNP at cut off level of 175 pg/ml increased the combine explanatory power of the history, signs, radiological studies and lab findings consistent with available literature 11, 12 16, 17.

#### CONCLUSION:-

Rapid measurement of plasma BNP levels appears to be a sensitive and specific test for differentiating cardiac dyspnea from non cardiac causes i.e pulmonary causes in emergency setting. This is the most underutilized investigation in our clinical practice so it is high time to use this investigation for diagnosis as well as guiding our management of heart failure patients.

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